AN

# ESSAY

ON

*Mechanismus de Respiratio.*

RESPECTFULLY SUBMITTED TO THE FACULTY

of the

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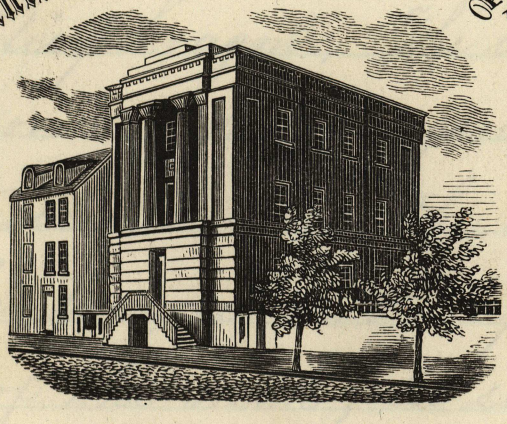

FOR

The Degree of Doctor of Medicine

BY

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# Mechanism of Respiration

The organs of respiration are the larynx, the trachea and its bronchial branches and terminations, the lungs, and the diaphragm; The larynx is properly considered the organ of voice, and is situated between the trachea and base of the tongue, at the upper and fore part of the neck; In shape, it is narrow and cylindrical below, and at its upper extremity, it presents the form of a triangular box, being flattened behind and at the sides, whilst in front it is bounded by a prominent

vertical ridge, whose superior portion forming a vertical projection has been named the "Pomum Adami"; Its anatomical conformation consists of cartilages, ligaments, muscles and mucous membrane, it is also supplied with vessels and nerves; The cartilages are nine in number commencing with the Thyroid, Cricoid, and Epiglottis, the Two Arytenoid, two Corniculæ Laryngis and Two Cuneiform.

The trachea or wind-pipe, is a cartilaginous and membranous cylindrical tube, flattened posteriorly, and extending from the lower extremity of the larynx, on a level with the fifth

cervical vertebra, to opposite the third dorsal, where it divides into two branches, called the bronchi, which pass respectively into the two lungs; here they subdivide into smaller branches and these again into branches still smaller, until at length they terminate in minute cavities, which are called the air vesicles. These vesicles which are destined for the ultimate reception of the air that is taken in by the Trachea, are composed of a delicate membranous substance and are contained within the pulmonary lobules; It is upon these air vesicles, that the pulmonary arteries ramify that proceed from the

right side of the heart, it is also the point of origin of the pulmonary veins, and it is these two sets of vessels which compose the pulmonic circulation.

The lungs are the essential organs of respiration; they are two spongy bodies, of a conical shape, placed one in each of the lateral cavities of the chest, united about their upper third by the trunks of the bronchi, and seperated from each other by the mediastinum and its contents. The mediastinum is the space left in the median line of the chest by the non-approximation of the two pleurae, and contains within its boundary, anteriorly

the origins of the Sterno-hyoid and Sterno-
-thyroid muscles, the Triangularis sterni, the
internal mammary vessels of the left
side, the remains of the Thymus gland,
also some loose areolar tissue and lymphatic
vessels coming from the liver; the middle
or superior portion, contains the heart in-
-closed in the pericardium, the ascending
aorta, the superior Vena Cava, the bifurcation
of the trachea, Pulmonary arteries and veins,
and the Phrenic nerves; the posterior portion
contains the descending aorta, the greater
and lesser azygos veins and superior inter-
costal veins, the Pneumogastric and Splanchnic
nerves, the oesophagus, Thoracic duct and

some lymphatics. Each lung is divided into two principal parts, called lobes; (The right lung however, owing to its having a second fissure crossing its substance through the upper lobe, is divided into three lobes; The left lung has but two lobes.) and these are divided into a number of smaller parts or lobules, each lobule consisting of a branch of the air-tubes, with the accompanying blood-vessels, and the connecting inter-lobular areolar tissue. The lungs entirely fill up the cavity of the chest, (with the exception of that portion occupied by the mediastinum) so as to leave no vacant space between the pleurae, or the membrane which encloses

the lungs and that which lines the thorax, although in the healthy state of the chest, these membranes have no connexion, except at their origin, and admit of free motion upon each other.

The Thorax is a conical framework, connected with the middle region of the spine; It is the largest of the three cavities of the trunk, narrow above, broad below, somewhat flattened before and behind; it is composed partly of bone, and partly of cartilage; its sides are formed by the series of arched bones called the ribs; the spaces between which are filled up by the inter-costal muscles.

The lower part of the chest, which is contiguous to the abdomen, consists of the diaphragm, a thin musculo-fibrous septum, which separates the Thorax from the abdomen, forming the floor of the former and the roof of the latter: This organ (the diaphragm) owing to its muscular composition has the power of contraction, and is constituted the principal organ in the mechanism of respiration.

The mechanical act of respiration consists essentially in increasing the cavity of the chest. The diaphragm in its natural state, forms an arch which is convex towards its upper surface, so that when it contracts

it becomes flattened, and in this way increases the capacity of the Thorax. The Thorax is likewise increased in size by the contractions of the inter-costal muscles, although in a much less degree than by the contractions of the diaphragm; and it is generally conceived that the principal use of these muscles is, to fix the ribs, and prevent them from being drawn down by the contraction of the dia-phragm, and thus counteracting the effect which is produced by its action.

As the lungs are everywhere in contact with the cavity containing them, (through the medium of the pleurae) they are

necessarily expanded in an equal degree with the Thoray. In consequence of this expansion, their capacity is increased, and as there is a free communication with the atmosphere by means of the larynx and trachea, a portion of air enters them equal to their increased capacity. After sometime the muscles or rather the diaphragm and the inter-costals relax and the elasticity of the cartilages of the thoray brings back the parts to their former bulk, and the capacity of the lungs being thus diminished the additional portion of air which they had received is expelled; In a short time however,

the muscular contractions is are renewed, and is are again succeeded by relaxations; and this alternation which continues to the end of life, constitute the mechanical Proces of respiration. Hence it appears that the state of expiration is what may be termed the natural condition of the respiratory organs, or that in which they are found when the position of the parts is not affected by muscular contraction. We also perceive, that the air enters the lungs solely in consequence of the increased capacity of the thorax, which is affected by muscular contraction, that this is the only step in the Proces which can

properly be regarded as a vital action;
and that the rest of the mechanism
of respiration depends upon the elasticity
or other physical properties of the parts
concerned.

There are two curious subjects of inquiry
connected with the function of respiration,
which have abundantly exercised the genius
of physiologists — What is the cause of the
first inspiration in the newly born infant?
and what is the cause of the regular successions
of inspirations and expirations during the
remainder of life?, "Harvey, if we remember right, ask's the following question; Why is the
animal, when it has once breathed, under

the necessity of continuing to respire without intermission, when if the air had never been received into the lungs, the same animal might have remained sometime without exercising this function".

We think it was "Whytt," who gave the following answer to his query, which at the time it was given was very generally acquiesced in, "He supposes that, immediately after birth, an uneasy sensation is experienced in the chest from the want of air, which might be regarded as the appetite for breathing. To supply this appetite the intelligent principle with which the body is endowed produces the expansion of the chest, being seemingly aware of the

fatal consequences that would result from the expulsion of fresh air." It is sufficient to remark concerning this hypothesis, that it labors under the defects of all the speculations of the meta-physical physiologists, That it confounds the finale with the efficient cause, and supposes the agency of a principle, the existence of which is itself a point which must be believed, without its existence having been proved. Perhaps it would be difficult to give any answer to Harveys query, which would be altogether satisfactory; but there is one point which may tend to throw some light upon this obscure point. We refer to the mechanical change which the chest experiences when the young

animal leaves the uterus, Before this time, in consequence of the position of the foetus, the lungs are compressed into as small a space as possible, and are nearly impervious to the blood; but when the trunk is extended, and the parts are allowed to exercise their natural elasticity, the ribs rise up, and the diaphragm descends, so that the dimensions of the chest are extended in both directions, The Thorax being thus brought into its state of average distension, and there being a free passage through the mouth, the air necessarily rushes in to supply the vacancy Thus produced.

The second subject of inquiry that was pointed out, regards the regular alternation

of inspiration and expiration. The attempts that have been made to solve this problem are very numerous; but we are disposed to regard them all as inadequate to the end in view; nor are we able to afford any explanation which is entirely satisfactory; We are indeed disposed to consider this action as depending upon different principles, according to the manner in which it is carried on, whether in the ordinary process of respiration, or when the lungs, from any cause, are excited to an extraordinary effort. In the first case, it would appear that when the blood has passed through the systemic circulation, it undergoes a change which renders it no longer

fit for performing the functions necessary for the continuance of life, In some way or other, which we shall not now attempt to explain, when the blood comes into this state an uneasy sensation is experienced about the heart, which sensation is removed by taking a portion of fresh air into the lungs. Whether the sensation itself serves as a stimulus to the muscles, or to the nerves connected with the organs of respiration; (which latter is the most probable to us) or whether the blood produces some more complicated train of changes, which eventually ends in the contraction of the muscles concerned in respiration,

is a point which we are unable to determine; but the result is, that a necessary connexion is established between these action, in consequence of which the diaphragm contracts, whenever the blood is returned to the heart in a venalized state.

If the foregoing subject should happen to contain erroneous ideas, or mistaken impressions, we ask the kind indulgence of our Superiors, upon the plea, "That to err is human, to forgive divine". All of which is respectfully submitted.

Jeremiah N. Brickley